

REMARKS

The applicants originally submitted claims 1-9 in this application. In responses to previous Office Actions, the applicants amended claims 1, 2, 4, 5 and 7, canceled claim 9, and added a new claim 10. In this amendment, the applicants have amended claims 1, 2 and 10. Accordingly, claims 1-8 and 10 remain pending in this application.

Amendment of Claim 1

Claim 1 is amended to require that the drawn fiber have a transmission loss that is less than 0.33 db/km at 1385 nm. Claim 1 is further amended to specify the time period during which the optical fiber needs to be exposed to deuterium at room temperature, and at a partial pressure of between approximately 0.01 and 0.05 atmospheres, in order to limit any future increase in transmission loss at 1385 nm to an amount that is less than 0.04 db/km. Support for these limitations is found at paragraphs [0011], [0014], [0030], [0042] - [0044], and [0046] of the specification. These limitations were previously within claim 9, which was previously canceled. With regard to optical transmission loss at 1385 nm after deuterium treatment, claim 9 recited that any loss increase thereafter (i.e., after deuterium treatment) would be less than 0.04 db/km. The Examiner has previously stated that no patentable weight would be given to the word "thereafter" because "patents only cover the past and present - not the future. No one has the ability to predict the future." This line of reasoning is respectfully traversed.

Applicants respectfully assert that accelerated hydrogen aging can be used to determine the future hydrogen-aging increase in transmission loss at 1385 nm. The effects of hydrogen, particularly OH ions, in an optical fiber are well known. Indeed, as early as 1980 F. Hanawa et al. disclosed the *Fabrication of Completely OH-Free V.A. D. Fiber* in Electronics Letters, Aug. 28, 1980, vol. 16, No. 18, at pp 699-700. More recently, the effects of hydrogen aging were discussed in a paper by Chang et al. entitled "*New Hydrogen Aging Loss Mechanism in the 1400 nm Window*," Feb. 21-26, 1999, OFC/IOOC'99 (Optical Fiber Communication Conference and the International Conference of Integrated

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Optics and Optical Fiber Communications, San Diego CA, USA, which is enclosed for the Examiner's review. In this paper it is pointed out that numerous accelerated hydrogen aging studies had been conducted on the relatively slow hydrogen reactions between various Si, Ge, P, etc. defects. Significantly, this paper reports that a permanent hydrogen-aging loss increase of up to a few tenths of db/km, at the 1385 nm "OH" peak, can occur at room temperature in a few days when a silica fiber is exposed to 0.001 to 0.01 atmospheres of hydrogen. Accordingly, accelerated hydrogen aging can be used to determine the future hydrogen-aging increase in transmission loss at 1385 nm.

It is well known that transmission loss of an optical fiber increases with age because hydrogen migrates into the light-carrying region of the fiber and forms OH ions at silicon-defect sites, discussed below. Nevertheless, over the lifetime of the optical fiber, hydrogen will migrate into these sites, form OH groups, and undesirably absorb optical transmission energy in the 1385 nm region. The present invention solves this problem by causing deuterium to migrate into these sites, form OD groups, and absorb optical transmission energy in another wavelength region that is outside the normal optical transmission band 1200 - 1600 nm. The presence of deuterium at these sites precludes hydrogen from subsequently forming OH groups there.

The time period of room-temperature deuterium exposure is determined by how long it takes for deuterium to fill a sufficient number of silicon-defect sites so that over the lifetime of the optical fiber, hydrogen-aging loss is less than 0.04 db/km.

Rejection – 35 USC §112

The Examiner has rejected claims 1-8 and 10 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that the applicants regard as the invention. More specifically, the Examiner indicates that the term "Si defects" is indefinite as to its meaning. Initially, the Examiner indicates that there is no definition for the term "Si defects." The applicants respectfully note that that the term is explained with sufficient clarity in the applicants' specification. As discussed in the

applicants' paragraph [0010], silicon defects are one of various defects in an optical fiber that react with hydrogen. Additionally, paragraph [0012] identifies certain specific silicon defects Si-O and Si-. When such defects react with hydrogen (undesirable) or deuterium (desirable) they are no longer considered "defects." As discussed above, reaction with hydrogen undesirably leads to increased optical transmission loss at 1385 nm whereas reaction with deuterium does not.

Secondly, the Examiner states that paragraph [0042] of the applicants' specification "discloses that the treatment does not reduce the number of defects, rather it seems to convert them to less harmful defects." The applicants respectfully disagree with such conclusion. The applicants submit that it is clear from reading the cited paragraphs [0010] that SiD is not a defect because it is no longer free to react with hydrogen. Moreover, SiH is not a defect either. However, the present invention is directed to reacting silicon defects with deuterium to preclude their subsequent reaction with hydrogen.

The Examiner has further rejected claims 1-8 and 10 under 35 U.S.C. §112, second paragraph because the term "room temperature" is indefinite as to its meaning, and cites the everything2.com website for the proposition the room temperature can be from -10° C to 50° C. However, the everything2.com website also states that physicists usually consider room temperature to be between 21° C and 23° C, and that European chemical data sheets list properties of material at 25° C. Moreover, the everything2.com website states that "Room temperature refers to the temperature of what is considered to be a 'normal' room. The possibility that *your room may be just above freezing or a sauna is irrelevant*" (boldface emphasis added). Accordingly, the Examiner's position that room temperatures comprise -10° C (below freezing) and 50° C (above sauna) is not what one of ordinary skill in the art would consider to be a 'normal' room.

Applicants submit that the term "room temperature" is a generally known term, as evidenced by the various dictionary entries submitted herewith. For example the Condensed Chemical Dictionary, Ninth Edition, defines room temperature as "an interior temperature from 20 to 25° C (68 to 77° F)." In

Wikipedia, the free encyclopedia, there is no mention of any temperature outside the range 21° C to 25° C in its discussion of room temperature. Similarly the Answers.com website uses the Wikipedia definition of room temperature.

In view of these remarks, the applicants submit that claims 1-8 and 10 are not indefinite, that room temperatures are generally understood to refer to temperatures that are between approximately 20 and 25° C, and respectfully request that the Examiner withdraw the rejection under 35 USC §112, second paragraph.

The Examiner has rejected claims 2, 3 and 10 under 35 U.S.C. §112, first paragraph, as failing to comply with the written description. More specifically, the Examiner indicates that there is no support in the applicants' specification for the exposure steps having the claimed pressures. In response, the applicants have amended claims 2 and 10 to clarify that there is no "further" exposure step, i.e., the subject matter in claims 2, 3 and 10 each further qualify the subject matter recited in claim 1. Support for the amendments is found in the applicants' specification, e.g., in paragraph [0013].

In view of the claim amendments, the applicants submit that claims 2, 3 and 10 are supported properly by the applicants' specification. Therefore, the applicants respectfully request that the Examiner withdraw the rejection under 35 U.S.C. §112, first paragraph.

Rejection – 35 USC §102

The Examiner has rejected claims 1 and 3-8 under 35 U.S.C. §102(b) as being anticipated by *Atkins* (U.S. Patent No. 5,287,427) or *Lemaire* (U.S. Patent No. 5,487,371). The applicants respectfully traverse the rejection in view of the claim amendment set forth above and the remarks set forth below.

The applicants have amended claim 1 to clarify that the drawn optical fiber has a transmission loss that is less than 0.33 db/km at 1385 nm, and is exposed to the atmosphere containing deuterium for a time period that is sufficient to limit any future hydrogen-aging increase in transmission loss at 1385 nm to less than 0.04 db/km.

Atkins discloses a method for making an optical component that involves exposing the optical waveguide to hydrogen and irradiating at least a portion of the optical waveguide to change the refractive index of the irradiated portion. The Examiner indicates that, in *Atkins*, the disclosed hydrogen exposure step (at 208 atmospheres) inherently exposes the optical waveguide to the naturally occurring deuterium in the hydrogen (0.015%) at a partial pressure of 0.0312 atmospheres ($208 \times 0.00015 = 0.0312$).

However, the applicants respectfully submit that exposing a drawn optical fiber to 208 atmospheres of hydrogen, as disclosed in *Atkins*, will have the opposite effect as required by amended claim 1. More specifically, exposing an optical fiber to an atmosphere containing hydrogen having an inherent concentration of deuterium of only 0.015% assures that hydrogen, rather than deuterium, will primarily fill the Si-defect sites. See *Atkins*, at col. 7, lines 61-68. In *Atkins*, optical loss at 1390 nm in the OH(OD) treated area is $> 0.1\text{db/cm}$ (i.e., $>10,000 \text{ db/km}$), which is more than 4 orders of magnitude greater than the applicants' recited optical loss at 1385 nm of 0.33 db/km. Moreover, even the loss in the relatively low-loss regions of *Atkins*, 0.001 db/cm (100 db/km), is more than 2 orders of magnitude greater than the applicants' recited loss.

With respect to *Lemaire*, a method for making a Bragg grating is disclosed in which hydrogen or deuterium exposure enhances the effect of UV radiation for increasing the index of refraction of portions of the grating. The pressures recited by *Lemaire* are in the range 14 – 11,000 psi (i.e., 1 – 750 atmospheres). In contrast, all claims of the present invention require that the partial pressure of deuterium be between approximately 0.01 and 0.05 atmospheres.

Nevertheless, the Examiner states that *Lemaire* discloses a hydrogen pressure that would have a partial pressure of 0.066 atmospheres of deuterium-containing molecules, and that 0.066 is deemed to be "between approximately 0.01 and 0.05 atmospheres." The Examiner calculates that this partial pressure of deuterium is present in a high pressure hydrogen environment because deuterium has an inherent concentration of 0.015% in a hydrogen atmosphere. Applicants agree with the Examiner that a partial pressure of 0.066 atmospheres

is included in the recitation of "approximately 0.01 and 0.05 atmospheres." However, the exposure of optical fiber to an environment containing 99.985% hydrogen and 0.015% deuterium would cause the same increase in transmission loss at 1385 nm as discussed above in connection with *Atkins*. Namely, exposing an optical fiber to an atmosphere containing such a concentration of hydrogen assures that hydrogen, rather than deuterium, primarily fills the Si defect sites and produces the exact opposite result required by amended claim 1. Indeed, as stated in the above-referenced paper by Chang et al. entitled "*New Hydrogen Aging Loss Mechanism in the 1400 nm Window*," a hydrogen-aging loss increase of up to 0.21 db/km at the 1385 nm OH peak can arise when an optical fiber is exposed to 0.01 atmospheres of hydrogen for less than 4 days at room temperature. Therefore, if such a small amount of hydrogen can cause a loss increase of up to 0.21 db/km, then exposing an optical fiber to hundreds of atmospheres of hydrogen will only increase the loss. However, treatment with deuterium as recited in amended claim 1, limits any future loss increase to less than 0.04 db/km.

Accordingly, the applicants respectfully request that the Examiner withdraw the rejection of claims 1 and 3-8 under 35 U.S.C. §102(b) as being anticipated by *Atkins* or *Lemaire*.

Rejection – 35 USC §103

The Examiner has rejected claims 1 and 3-8 under 35 U.S.C. §103(a) as being unpatentable over *Atkins* 5287427 or *Lemaire* 5487371. The applicants respectfully traverse the rejection in view of the claim amendment set forth above and the remarks set forth below.

Both *Atkins* and *Lemaire* disclose exposing an optical fiber to an atmosphere containing hydrogen or deuterium for the purpose of increasing the index of refraction in selected portions of the fiber to thereby create a grating, and both references write gratings onto AT&T's 5D fiber (see *Atkins* at col. 3, line 41, and *Lemaire* at col. 4, line 60). However, as pointed out in *Atkins* at col. 7, lines 61-68, the loss in the relatively low-loss regions of this fiber, 0.001 db/cm (100 db/km), is more than 2 orders of magnitude greater than applicants' recited

optical loss at 1385 nm of 0.33 db/km. More importantly, loss in the OH(OD) treated area is > 0.1db/cm (*i.e.*, >10,000 db/km), which is more than 4 orders of magnitude greater than the applicants' required optical loss. One can reasonably conclude that OH(OD) treatment produces a hundred-fold increase in optical transmission loss at 1385 nm.

One of ordinary skill in the art seeking to limit the lifetime loss of an optical fiber at 1385 nm to less than 0.37 db/km (*i.e.*, 0.33 db/km + 0.04 db/km) would not use OH(OD) treatment as disclosed in *Atkins* or *Lemaire*. Accordingly, applicants respectfully submit that neither *Atkins* nor *Lemaire* render the amended claims of the present invention obvious under 35 USC §103(a).

Applicants believe that claims 1-8 and 10 are now in patentable form, and respectfully urge that they be allowed and the application be passed to issue. If the Examiner disagrees, the Examiner is invited to call applicants' attorney at the telephone number provided below in order to expedite prosecution.

Respectfully,

Kai H. Chang

David Kalish

Thomas J. Miller

By:



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Date: Oct. 5, 2006

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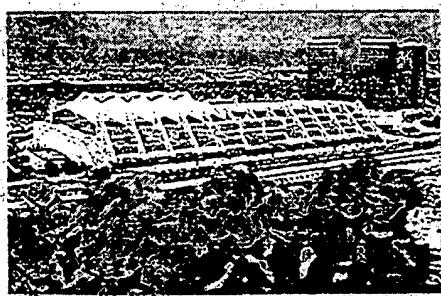
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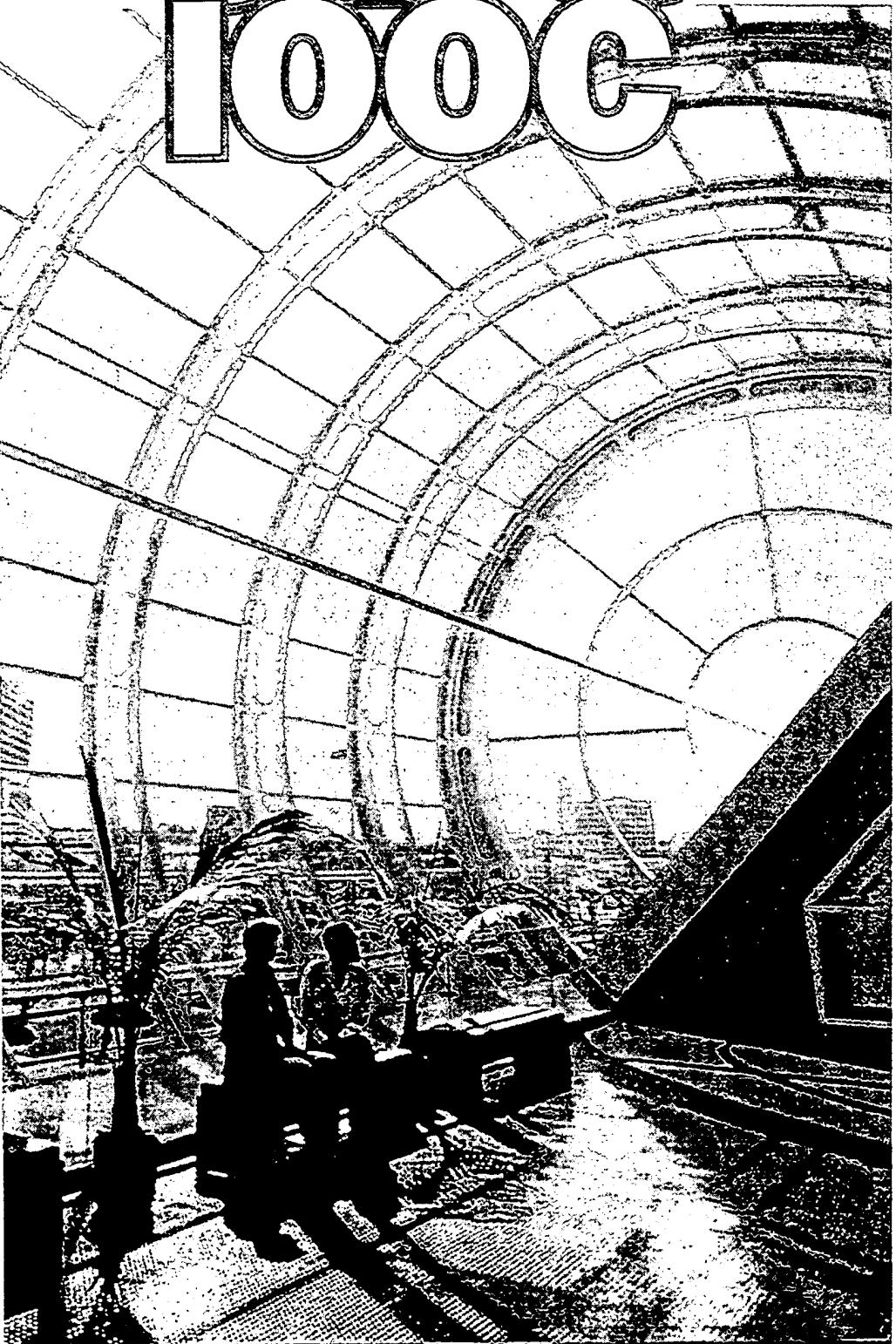


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Thursday, February 25, 1999

Room 6A

Robert W. Tkach, *AT&T Labs-Research, USA, Presider*

5:45pm

PD1—3 Tbit/s (160 Gbit/s x 19 ch) OTDM-WDM Transmission Experiment, S. Kawanishi, H. Takara, K. Uchiyama, I. Shake, and K. Mori, *NTT Network Innovation Laboratories, Japan.* 3 Tbit/s (160 Gbit/s x 19 channels) optical signal is successfully transmitted over 40 km dispersion-shifted fiber. Low noise supercontinuum signal pulse sources and 70 nm bandwidth tellurite-based optical amplifiers are used for 3 Tbit/s signal generation and amplification.

5:55 pm

PD2—640 Gb/s Transmission of Sixty-four 10 Gb/s WDM Channels Over 7200km with 0.33 (bits/s)/Hz Spectral Efficiency, N.S. Bergano, C.R. Davidson, C.J. Chen, B. Pedersen, M.A. Mills, N. Ramanujam, H.D. Kidorf, A.B. Puc, M.D. Levonas, and H. Abdelkader, *Tyco Submarine Systems, Ltd., USA.* Sixty-four 10 Gb/s WDM channels were transmitted over 7200 km in a spectral bandwidth of 15.1 nm for a spectral efficiency of 0.33 (bits/s)Hz. Error free operation was achieved for all channels.

6:05pm

PD3—1220 km Propagation of 40 Gbit/s single Channel RZ Data Over Dispersion Managed Standard (Non-dispersion Shifted) Fibre, S.B. Alleston, P. Harper, I.S. Penketh, I. Bennion, N.J. Doran, *Photonic Research Group, UK*, A.D. Ellis, *BT Labs, UK.* Error free propagation of a single polarisation optical time division multiplexed 40Gbit/s dispersion managed puls data stream over dispersion shifted fibre. This distance is twice the previous record at this data rate.

6:15pm

PD4—Narrow Bank 1.02 Tbit/s (51 x 20 Gbit/s) Soliton DWDM Transmission Over 1000km of Standard Fiber with 100 km Amplifier Spans, D. LeGuen, S. DelBurgo, M.L. Moulinard, D. Grot, M. Henry, F. Favre, and T. Georges, *France Telecom CNET, France.* 1.02 Tbit/s (51-wavelength each at 20 Gbit/s) dense WDM (0.4 nm channel-spacing) soliton transmission over 1000 km of standard step-index fiber with 100 km (21 dB loss) amplifier spans was successfully achieved for the first time.

6:25pm

PD5—500 Gb/s (50 x 10)Gb/s WDM Transmission Over 4000km Using Broadband EDFAs and Low Dispersion Slope Fiber, K. Imai, T. Tsuritani, N. Takeda, K. Tanaka, N. Edagawa, and M. Suzui, *KDD R&D Laboratories, Inc., Japan.* 500 Gb/s, over 4000km transmission was moderated with 22nm-bandwidth EDFA and low dispersion slope fiber. By reducing the dispersion slope and fiber nonlinearity, the transmission distance was almost doubled compared to the previous experiments with similar capacity.

6:35pm

PD6—80 Gbit/s Single Wavelength OTDM Soliton Transmission Over 172km Installed Fiber, J. Hansyrd, B. Bakshi, B.E. Olsson, P.A. Andrekson, J. Brentel, E. Kolltveit, *Photonics Laboratory, Chalmers University of Technology, Sweden.* Single wavelength soliton transmission at 80 Gbit/s has successfully been performed over 172km installed fiber. Soliton data with pulse widths of 4.5ps was transmitted with an average power penalty for all eight time-division-multiplexed channels of 1.3 dB.

Room 6C/6F
Turan Erdogan, University of Rochester, USA, Presider

5:45pm

PD19—100nm Bandwidth Flat Gain Raman Amplifiers Pumped and Gain-Equalized by 12-Wavelength-Channel WDM High Power Laser Diodes, Y. Emori, S. Namiki, *Opto-Technology Laboratory, Furukawa Electric Co., Ltd., Japan.* We demonstrate 100nm bandwidth Raman amplifiers using 12-wavelength channel WDM pump laser diode unit. The gain flatness is less than $\pm 0.5\text{Db}$, which is achieved through an asymmetric channel allocation of pump and without any gain equalization filters.

5:55 pm

PD20—Photosensitization of Optical Fiber by UV Exposure of Hydrogen Loaded Fiber, G.E. Knobke, D.W. Nightingale, and P.G. Wigley, *Corning Incorporated, USA*, C.R. Pollock, Cornell University, USA. We report a photosensitization process in standard hydrogen loaded optical fiber. A persistent photosensitivity is produced by exposure to UV light that can be uniform or spatially tailored along the fiber length.

6:05pm

PD21—All-Fiber Wavemeter and Fourier-Transform Spectrometer, M. Frogatt, *NASA Langley Research Center, USA*, T. Erdogan, *University of Rochester, USA.* An all-fiber Fourier-transform spectrometer is proposed and demonstrated. The device is simple, compact, and functions as a wavemeter, a network monitor, or a tool for fabrication and testing of very long fiber Bragg gratings.

6:15pm

PD22—New Hydrogen Aging Loss Mechanism in the 1400nm Window, K.H. Chang, D. Kalish, and M.L. Pearsall, *Bell Laboratories, Lucent Technologies, USA.* A new type of hydrogen aging loss increase of up to 0.21 dB/km at the 1385nm OH peak can arise in some fibers when exposed to 0.01 atmospheres of hydrogen for less than 4 days at room-temperature.

6:25pm

PD23—Single-End Continuous-Wave Polarization Mode Dispersion Measurement in Long Single-Mode Fibers, F. Corsi, A. Galtarossa, L. Palmieri, *DEI, Universita di Padova, Italy*, M. Schiano, T. Tambosso, *CSELT, Italy.* Single-end measurement of statistical properties of polarization mode dispersion parameters was carried out by means of a continuous wave scheme based on the analysis of the Fresnel reflection at fiber far-end.

6:35pm

PD24—Sub-10 Femtosecond Timing Jitter of a 10-GHz Harmonically Mode-Locked Fiber Laser, T.R. Clark, T.F. Carruthers, I.N. Duling, III, and P.J. Matthews, *Naval Research Laboratory, USA.* We present the lowest measurements of timing jitter, to our knowledge, of a harmonically mode-locked fiber laser. Phase detection noise measurements demonstrate a timing jitter of less than 10fs from 100 Hz to 1 MHz.

New Hydrogen Aging Loss Mechanism in the 1400 nm Window

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Abstract: A new type of hydrogen aging loss increase of up to 0.21 dB/km at the 1385 nm OH peak can arise in some fibers when exposed to 0.01 atmospheres of hydrogen for less than 4 days at room-temperature.

With the advent of zero-OH fiber (or zero-water fiber, typically with 1385 nm loss of 0.27 to 0.28 dB/km) and systems operating in the 1400 nm window (the "fifth" window), it is of critical importance to ensure fiber attenuation remains low in this new window over the lifetime of service. The optical attenuation in silica-based fibers at the 1400 nm window is particularly vulnerable to hydrogen-induced reactions between the trace amount of hydrogen encountered under service conditions and the various Si or Ge defects in fibers because SiOH and GeOH formed in such hydrogen reactions have absorption peaks centered around 1385 nm.

In the past 15 years, numerous accelerated hydrogen aging studies [1,2] have been conducted on the relatively slow hydrogen reactions between various Si, Ge, P, etc defects and hydrogen at high temperatures and high hydrogen partial pressures (up to 1 atmosphere and higher). The typical results of these studies are the predictions of long-term (e.g. 25 years) hydrogen aging losses at the 1310 and 1550 nm windows in the order of several thousandths of dB/km when the fiber is exposed to hydrogen partial pressures up to 0.01 atmospheres under service conditions. Hydrogen aging loss at the 1385 nm OH peak had not been the focus of past studies.

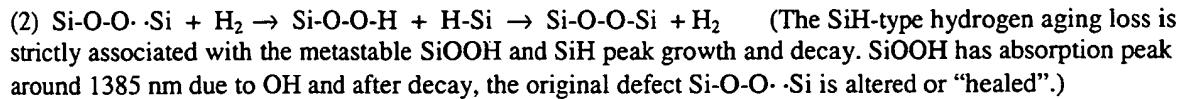
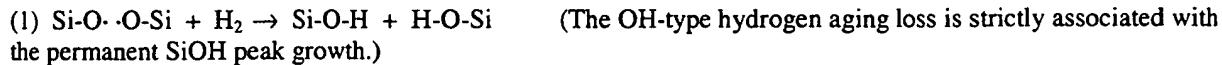
We report below a new permanent hydrogen aging loss increase of up to a few tenths of dB/km at the 1385 nm "OH" peak that can occur at room-temperature in a few days when a silica fiber is exposed to 0.001 to 0.01 atmospheres of hydrogen (we refer to this as the OH-type hydrogen aging loss). An example is shown in Figure 1, where an OVD matched-clad singlemode fiber was exposed to 0.01 atmospheres of hydrogen for 4 days at room-temperature and the 1385 nm loss increased by 0.21 dB/km. This type of hydrogen aging loss is particularly important to systems operating in the 1400 nm window because: (1) the loss increase could be sizable even upon a brief exposure to a small amount of hydrogen at ambient temperature and this could easily dwarf the conventional hydrogen aging loss effects mentioned in the previous paragraph, (2) the loss increase is permanent - heating of hydrogen-treated fibers does not reverse the added loss, and (3) the defects involved are so reactive with hydrogen that on a time scale of days, the reaction is practically instantaneous and this means that to avoid loss increase, even a trace amount of hydrogen (e.g. 0.01 atmospheres or less) cannot be tolerated in the fiber installation even briefly (~ 1 day) over the entire lifetime of the fiber (a truly unprecedented requirement for hydrogen concentration in fiber installation), and (4) the loss increase is not just at the 1385 nm OH peak - it has a long tail on the long-wavelength side and the affected wavelengths include 1310 to 1550 nm and beyond.

We have adopted a 0.01 atmosphere hydrogen treatment at room-temperature for 4 days as a screening test for this extremely reactive hydrogen aging loss at the OH peak. From testing numerous types of fibers, we found that the 1385 nm loss increase in this test was not the same for all fiber types and that usually the added loss reached saturation at the end of test, indicating the reaction was limited by the very small number of reactive defects in fiber. In general, MCVD and some VAD fibers showed very little 1385 nm loss increase (< 0.01 dB/km) in the test. A zero-OH fiber, made with a hybrid-VAD process, typically had a 1385 nm loss increase of 0.04 dB/km (see Figure 2). Other types of fibers had higher 1385 nm aging loss increase, ranging from 0.06 to 0.21 dB/km.

The OH-type hydrogen aging loss above should not be confused with another reactive defect [3,4] that can result in SiH (with a peak at 1530 nm) and OH (with a peak at 1385 nm) loss increases in the same hydrogen test. This SiH-type hydrogen aging loss (with the attendant 1385 nm OH peak growth also) is quite different from the OH-type in: (1) the spectral shape of the added attenuation and (2) a large fraction of the SiH absorption peak and a smaller fraction of the added OH peak can decay away at room-temperature in days to months. Normally, we do

not see the SiH-type hydrogen aging loss in our hydrogen test except for some OVD matched-clad fibers where a 0.01 dB/km 1530 nm SiH loss increase was observed in addition to the 0.08 dB/km 1385 nm OH peak increase.

It appears that both the OH-type and SiH-type hydrogen aging losses are related to defects in undoped silica cladding and they are most prevalent in undoped-silica clad fibers. The concentration of these silica defects depends strongly on the processing conditions and the presence of dopants; Ge tends to reduce the number of defects. It is possible to estimate the concentration of defects from the OH peak growth to saturation and well-known molecular hydrogen diffusivity. The silica defect concentrations we have observed range from ppb to ppm mole per mole of SiO_2 . We can speculate on the nature of these silica defects based on the results of our hydrogen aging loss studies. Two types of defects and their hydrogen reactions are proposed:



Furthermore, we speculate that the two types of defects, $\text{Si-O}\cdot\text{-O-Si}$ (the non-bridging oxygen hole centers, or NBOHC's) and $\text{Si-O-O}\cdot\text{-Si}$ (the peroxy radical and Si E' center respectively), arise from oxygen-rich processing conditions and they can co-exist in the same fiber. In fact, when the SiH-type hydrogen aging loss was observed, it was very often accompanied by the OH-type, although usually not vice-versa. The above is consistent with the following observations: (1) the decrease of the 630 nm absorption peak (assigned to $\text{Si-O}\cdot$) is strictly proportional to the growth of permanent OH peak increase (since they are associated with the OH-type hydrogen aging loss only) and (2) after the growth and decay of the OH and SiH peaks for the SiH-type hydrogen aging loss, additional treatment of fiber in hydrogen will not cause the growth of OH and SiH peaks again (because the original defect, $\text{Si-O-O}\cdot\text{-Si}$, is structurally changed or even "healed" by the initial hydrogen reaction). It is also clear that the OH-type hydrogen aging loss could easily be masked by the GeOH growth or the molecular hydrogen absorption in traditional accelerated aging tests with relatively high temperatures and hydrogen pressures and that it could also easily be missed in these tests because of the rapidity of this reaction (which reaches completion well before the molecular hydrogen in-diffusion stops). In other studies, the SiH-type (metastable) hydrogen aging loss could be mixed up with the OH-type (stable) loss increase because, as shown above, the two types of underlying silica defects can co-exist due to the common origin in oxygen-rich process conditions. Further studies on the reaction mechanisms may provide clues for reducing the number of defects in the processing steps, so that fibers are less sensitive to hydrogen aging losses.

In conclusion, some commercial fibers contain extremely reactive defects that result in loss increases in the 1385 nm (OH-type or SiH type) or even the 1530 nm region (SiH-type) upon exposure to trace amount of hydrogen (e.g. 0.01 atmospheres) at room-temperature for only a few days. The extent of the loss increases depends upon the process for making the fiber and the environment in which it is used. If the hydrogen partial pressure the fiber sees is much lower than 0.01 atmospheres (e.g. 0.0001 atmospheres), the hydrogen aging loss will still increase but at a slower rate, limited now by the number of hydrogen molecules available. The end of life hydrogen aging loss will depend on the total number of hydrogen molecules evolved in the fiber environment; but it is clear from our studies that it only takes a very small amount of hydrogen for the fiber to incur the maximum (saturated) aging loss increase. New standard tests are needed to measure the hydrogen aging losses discussed. In order to ensure the reliability of systems operating in the 1400 nm window, additional fiber specifications are also required.

References:

1. A. Tomita and P. J. Lemaire, "Hydrogen-Induced Loss Increases in Germanium-Doped Single-Mode Optical Fibers: Long-Term Predictions", *Electron. Lett.*, 21, no. 2, p. 71, (1985)
2. K. Kuwazuru, Y. Namihira, K. Mochizuki, and Y. Iwamoto, "Estimation of Long-Term Transmission Loss Increase in Silica-Based Optical Fibers under Hydrogen Atmosphere", *J. Lightwave Technol.*, 6, no. 2, p. 218, (1998)

3. M. Ogai, A. Iino, K. Matsubara, and O. Katsuhiko, "Absorption Peak at 1.52 μ m in Silica Fiber", *ECOC'86 Technical Digest*, pp. 7-10, (1986)
4. M. G. Blankenship, A. J. Morrow, and D. R. Powers, "Short-Term Transient Attenuations in Single-Mode Optical Fibers Due to Hydrogen", *OFC/IOOC'87 Technical Digest*, paper WA3, (1987)

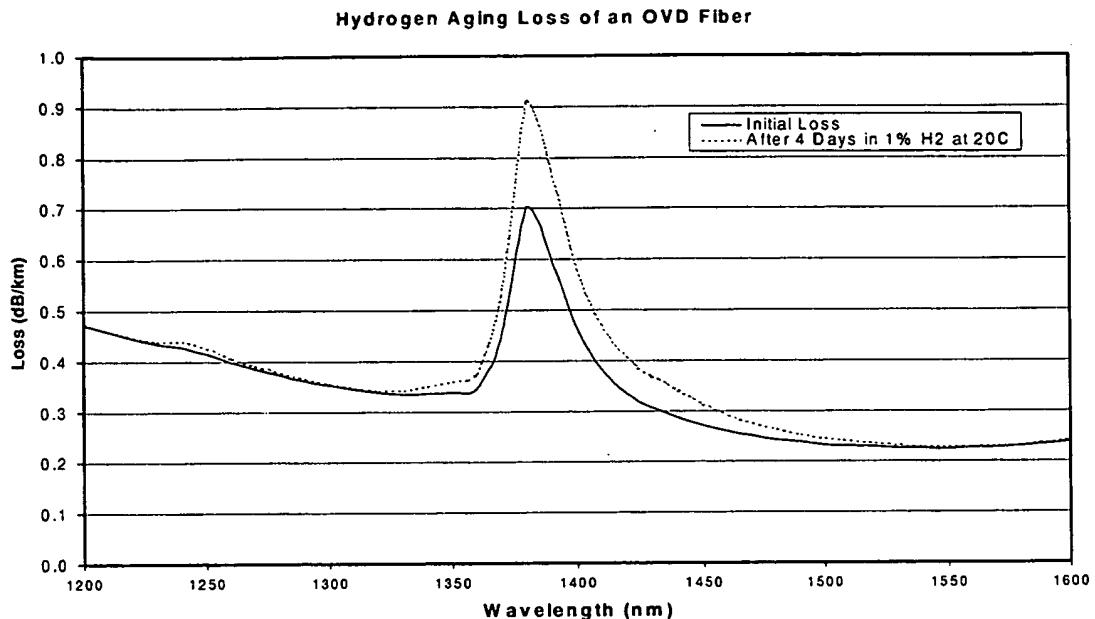


Figure 1: The initial loss of a matched-clad OVD singlemode fiber and its saturated loss after it was exposed to 0.01 atmospheres of hydrogen for 4 days at room-temperature (and storage in air for 14 days to allow molecular hydrogen to diffuse out of the fiber).

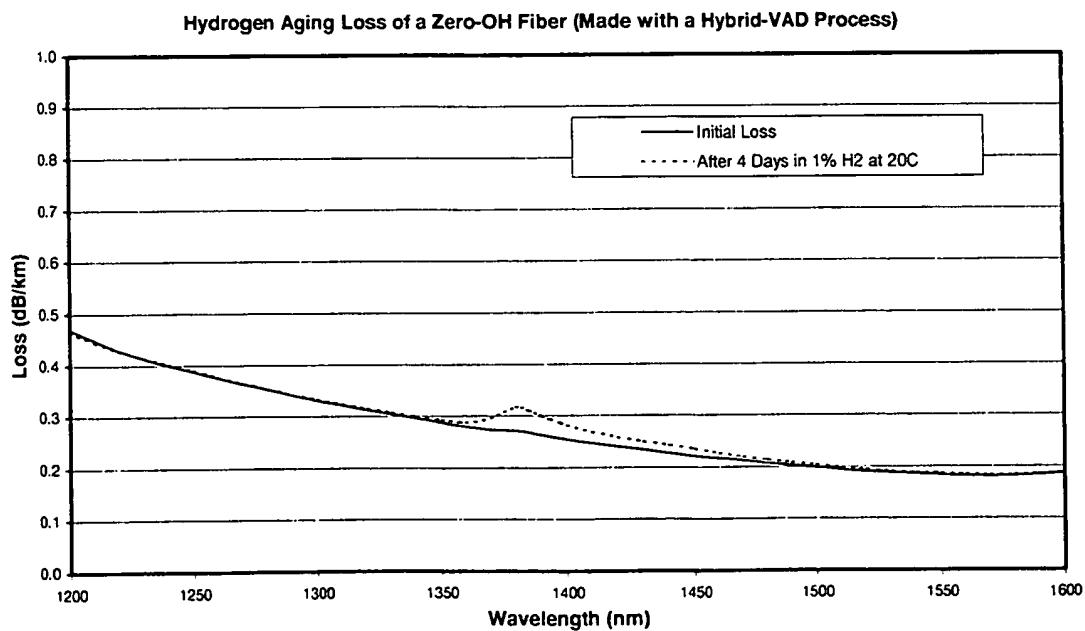


Figure 2: The initial loss of a zero-OH fiber (made with a hybrid-VAD process) and its saturated loss after it was exposed to 0.01 atmospheres of hydrogen for 4 days at room-temperature.

Room temperature

From Wikipedia, the free encyclopedia

Room temperature, in laboratory reports, is taken to be roughly 21–23 degrees Celsius (69–73 degrees Fahrenheit), or 294–296 kelvin.

In describing an experiment, when researchers specify its temperature no more precisely than as "room temperature," this implies they have assumed that temperature differences of a few degrees do not matter to the phenomenon or question they were investigating. Typically researchers do not closely watch or control the temperature of a "room temperature" experiment.

The phenomena that researchers may choose to study at room temperature can naturally occur in the range of 21–23 °C, or they may not. Researchers will choose to study a process outside its natural temperature range when they expect the conclusions to a specific question to be the same at room temperature as at a more natural temperature.

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See also

- Temperature

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NINTH EDITION

Revised by

GESSNER G. HAWLEY

*Coeditor, Encyclopedia of Chemistry
Coauthor, Glossary of Chemical Terms*



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"Rodine."¹⁴² Trademark for red squill liquid extract rodenticides.

"Rodo."⁶⁹ Trademark for a series of blended essential oils used to deodorize rubber.

Roentgen, W. K. (1845-1923). German physicist who discovered x-rays in 1895 for which he was awarded the Nobel Prize in 1901. Application of these to a number of important problems in analytical chemistry was developed by the Braggs, Moseley, von Laue, and Debye and Sherrer.

roentgen (r). The international unit of quantity or dose for both x-rays and gamma rays. It is defined as the quantity of x- or gamma rays which will produce as a result of ionization one electrostatic unit of electricity of either sign in 1 cc (0.001293 g) of dry air as measured at 0°C and standard atmospheric pressure. The use of the roentgen unit has been extended to include particle radiation such as alpha and beta particles and protons and neutrons. See also rad, curie.

Rohrbach solution.

Properties: Clear, yellow liquid. Very refractive; sp. gr. 3.5.

Derivation: An aqueous solution of mercuric barium iodide.

Hazard: Highly toxic by ingestion and inhalation.

Uses: Separating minerals by their specific gravity; microchemical detection of alkaloids.

"Romark."⁴⁴⁸ Trademark for alkyd and chlorinated rubber type road-marking paints.

ronnel. Generic name for O,O-dimethyl O-(2,4,5 trichlorophenyl) phosphorothioate, $(\text{CH}_3\text{O})_2\text{P}(\text{SOC}_6\text{H}_2\text{Cl}_3)$.

Properties: Powder or granules; m.p. 41°C. Insoluble in water; soluble in most organic solvents.

Hazard: Toxic by ingestion and inhalation. Tolerance, 10 mg per cubic meter of air. Cholinesterase inhibitor. Use may be restricted.

Use: Pesticide.

Shipping regulations: (Rail, Air) Organic phosphate, solid, n.o.s., Poison label. Not accepted on passenger planes.

"Ronopole" Oil.¹⁶⁵ Trademark for highly oxidized sulfonated castor oil.

room temperature. An interior temperature from 20 to 25°C (68 to 77°F).

"Roracyl."²⁸ Trademark for a group of soluble dyes that have good affinity and fastness properties on leather.

"Rosaldehyde."¹⁸⁸ Trademark for a synthetic floral perfume base.

rosaniline $\text{HOC}(\text{C}_6\text{H}_4\text{NH}_2)_2\text{C}_6\text{H}_3(\text{CH}_3)\text{NH}_2$. A triphenylmethane dye.

Properties: Reddish brown crystals; m.p. 186°C (dec). Soluble in acids and alcohol; slightly soluble in water.

Hazard: May be toxic.

Uses: Dye (usually as the hydrochloride); fungicide.

"Rosanlik."¹⁸⁸ Trademark for a synthetic replacement of otto of rose.

roscoelite $\text{K}_2\text{V}_4\text{Al}_2\text{Si}_6\text{O}_{20}(\text{OH})_4$. A vanadium-bearing species of mica (q.v.). Formula variable, with V_2O_3 up to 28%. Occurs as minute scales with micaceous cleavage; dark green to brown in color; pearly luster. Mohs hardness 2.5; sp. gr. 3.0.

Occurrence: Colorado, California, Australia.

Use: Source of vanadium.

rose absolute. Pure oil of rose. The first filtrate obtained on separation of waxes from the cooled alcohol solution of rose concrete in perfume manufacture.

rose concrete. Semisolid residue, a mixture of essential oils and waxes, resulting from extraction of rose flower petals, leaves, seeds, fruit, roots, gums or bark by means of a volatile solvent.

rose oil (otto of rose oil; attar of roses; rose flower oil) Properties: Pale yellow, pale green, or pale red, transparent, essential oil; mild, sweet taste; strong, fragrant odor; semi-solid at room temperature. Sp. gr. 0.845-0.865; solidifying point 18-37°C; saponification value 10-17; acid value 0.5-3; refractive index (n 30/D) 1.457-1.463. Combustible; nontoxic. Chief constituents: Geraniol, citronellol and phenylethyl alcohol.

Derivation: By steam distillation of the fresh flowers of *Rosa damascena*, *Rosa centifolia*, *Rosa gallica* and *Rosa alba*.

Grades: Bulgarian; French; Turkish; N.F.; F.C.C.

Uses: Perfumes; flavoring.

"Rosetone."¹⁹ Trademark for trichloromethylphenylcarbinyl acetate (q.v.).

rosewood oil. See oil bois de rose.

rosin

Properties: Angular, translucent, amber-colored fragments; sp. gr. 1.08; m.p. 100-150°C; acid no. not less than 150. Flash point 370°F. Insoluble in water; freely soluble in alcohol, benzene, ether, glacial acetic acid, oils, carbon disulfide, dilute solutions of fixed alkali hydroxides. Low toxicity. Hard and friable at room temperature; soft and very sticky when warm. Combustible.

Chief constituents: Resin acids of the abietic and pinmaric types, having the general formula $\text{C}_9\text{H}_{10}\text{COOH}$, and having a phenanthrene nucleus. See also turpentine.

Derivation: From pine trees, chiefly *Pinus palustris* and *Pinus caribaea*. (a) Gum rosin is the residue obtained after the distillation of turpentine oil from the oleoresin tapped from living trees. (b) Wood rosin is obtained by extracting pine stumps with naphtha and distilling off the volatile fraction. (c) Tall oil rosin is a byproduct of the fractionation of tall oil (q.v.).

Grades: Virgin; yellow dip; hard; N.F. Wood rosin is grades B, C, D, E, F, FF, G, H, I, J, K, L, M, N, W-G (window-glass), W-W (water-white). The grading is done by color, B being the darkest and W-W the lightest.

Containers: Drums; multi-wall paper bags.

Uses: Hot-melt and pressure-sensitive adhesives; mastics and sealants; varnishes; ester gum; soldering compounds; core oils; insulating compounds; soaps; paper sizing, printing inks; polyesters (formed by reaction of the conjugated acids of rosin with acrylic acid, followed by reaction with a glycol). See also abietic acid.

rosin oil.

Properties: Water-white to brown liquid; viscous; odorless; strong, peculiar taste. Soluble in ether, chloroform, fatty oils and carbon disulfide; slightly soluble in alcohol; insoluble in water. Essentially decarboxylated rosin acids. Sp. gr. 0.980-1.110; iodine number 112-115.

Derivation: By fractional distillation of rosin, that portion distilling above 360°C being rosin oil.

Containers: Drums; tank cars.

Hazard: Spontaneous heating; fire risk when heated.

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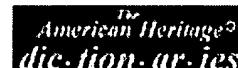
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room temperature

n. (Abbr. RT)

An indoor temperature of from 20 to 25°C (68 to 77°F).

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The noun room temperature has one meaning:

Meaning #1: the normal temperature of room in which people live

Wikipedia



room temperature

Room temperature, in laboratory reports, is taken to be roughly 21-23 degrees Celsius (69-73 degrees Fahrenheit), or 294-296 kelvin.

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See also

- [Temperature](#)

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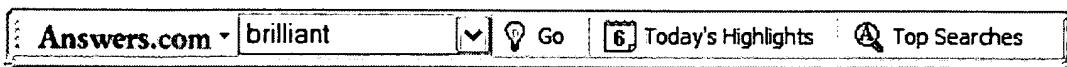


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